REVISED DRAFT

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INTERIM FUNCTIONAL ASSESSMENT MODEL FOR PLAYA WETLANDS

CLASS: DEPRESSIONAL

SUBCLASS: HIGH PLAINS PLAYAS

EXPLANATION OF MODEL USE

This interim model is to be used in the field to assess the functional capacity of a wetland and to determine the mitigation requirements associated with the projected loss of a wetland. This model is intended to be user friendly: the first part has the Model Variables and the Worksheets to be used in the field and the second part has a User's Guide for additional information such as the explanation of each function and their associated variables.

To use this model:

First, review each model variable at a wetland site in the field. Definitions and examples of each variable are given. For each variable decide what measurement or condition best describes the wetland site and assign it the corresponding index number using the Variable/Index Worksheet for recording.

Second, transfer the index numbers from the Variable/Index Worksheet to the appropriate equations on the Functional Capacity Index Equation Worksheets. Not all equations are used depending on hydrology: closed or throughflow, outlet or no outlet. Sum up each equation and also sum for the four regimes: hydrology, biogeochemical, vegetation, and wildlife to determine the functional capacities. A calculator that has square root capabilities is necessary and/or the Lotus and Excel Worksheets can be used. This completes the functional assessment for the wetland assessment area.

Third, determine the area to be mitigated and use the Mitigation Ratio Worksheet and/or the Lotus and Excel Worksheets to record on. Transfer the functional capacities (wetland impacts) of the assessment area to the worksheet. Determine the functional capacities of the proposed mitgation area and then calculate the mitigation ratio. This completes the mitigation requirements for the wetland mitigation area.

Exhibit A
Model Variables with Index

Model Variable	Measurement or Condition	Index
$V_{BUFFCON}$: Buffer Zone Continuity Definition: Percentage of buffer zone surrounding the wetland. Example: Grazing, burning, tillage, development, and drainage activities in the buffer zone impact plant communities and elemental cycling throughout the wetland ecosystem.	Continuity is > 90%. Continuity is 75% to 90% Continuity is 50% to 74% Continuity is 25% to 49% Continuity is Less Than 25%	1.0 0.75 0.5 0.25 0.0

Model Variable	Measurement or Condition	Index
$V_{BUFFWID}$: Buffer Zone Width Definition: Condition of the buffer zone adjacent to the wetland. Example: Grazing, burning, tillage, development, and drainage activities in the buffer zone impact plant communities and elemental cycling throughout the wetland ecosystem.	Relatively undisturbed with evidence of surface water movement to the wetland. Minimum of 100 feet wide buffer with native perennial vegetative cover. Some disturbance with indications of water movement to the wetland. Buffer 50 to 99 feet wide undisturbed with native perennial vegetative cover. Some disturbance with indications of water movement to the wetland. Buffer with 10 to 49 feet wide with perennial vegetative cover. Disturbances with indications of high rate of runoff with a buffer width of less than 10 feet.	1.0 0.5 0.25 0.0

Model Variable	Measurement or Condition	Index
V_{CANOPY}: Canopy Cover Definition: The measurement of the canopy cover of herbaceous vegetation within the wetland. Example: Change in canopy cover from a reference standard site omdocates indicates impacts adding to the quality of the wetland.	The measure of canopy cover in the wetland is 75 to 125% (overlapping canopies). The measure of canopy cover is 50% to 75% or greater than 125%. The measure of canopy cover is 25 to 50%. The measure of canopy cover is 10 to 25%. Vegetation is sparse or absent (0-10%).	1.0 .75 .50 .25 0.0

Model Variable	Measurement or Condition	Index
$V_{DETRITUS}$: Detritus Definition: The presence of litter, on the wetland surface in several stages of decomposition. Example: Detritus affects microbial activity and soil organic matter.	Litter is Greater Than 2cm thick. Litter is 1 to 2cm thick. Litter layer is Less Than 1cm thick. Litter absent	1.0 0.5 0. 1 0.0

Model Variable	Measurement or Condition	Index
V_{LANDSP}: Landscape Definition: Condition of landscape within a 1 mile radius of center of the wetland being assessed. Example: Conditions of landscape in vicinity of wetland determines the quality of potential dispersal area and home range for fauna that depend upon a mosaic of wetland and upland habitats.	Surrounding landscape supports is Greater Than 75% mosaic of native plant community. Ecological Site Similarity Index is Greater Than 35%. Surrounding landscape supports 50% to 75% mosaic of the native plant community. Ecological Site Similarity Index Index is Greater Than 35%. Surrounding landscape supports 25% to 50% mosaic of the native plant community. Surrounding landscape supports Less Than 25% mosaic of the native plant community.	1.0 0.5 0.1 0.0

Model Variable	Measurement or Condition	Index
V_{MICRO}: Microtopographic Roughness Definition: Microtopographic relief that contributes to (a) surface roughness and (b) abrupt site water balance variation on the wetland surface and (c) surfaces for microbial activity. Exmple: Gilgais are an example of microtopographic roughness. Vegetation differs on the convex versus the concave surfaces. Tillage can reduce or eliminate microtopographic roughness.	Microtopographic relief present in 76 to 100% of the wetland assessment area. Microtopographic relief present in 51 to 75% of the wetland assessment area. Microtopographic relief present in 26 to 50% of the wetland assessment area. Microtopographic relief present in < 25% of the wetland assessment area.	1.0 .75 .50 .25

Model Variable	Measurement or Condition	Index
V_{MOD}: Modifications Definition: Presence of constructed excavations (concentration pits or trenches), constructed outlets, or fill which affect water paths and duration of ponding and/or saturation in the wetland. Example: Excavations in the wetland alter flow paths within the wetland, concentrate water in confined areas, reduce duration's of wetness, and may allow loss of water through the substrate.	No excavations or constructed outlet/fill in the wetland. Pits and or other man- made excavations within the wetland do not hold more than 10% of the total water volume **AND/OR** bottom of constructed outlet(s) is at least 2ft. above the bottom elevation of the wetland. Pits and or other man- made excavations within the wetland do not hold more than 25% of the total water volume **AND/OR** bottom of constructed outlet(s) is at least 1ft. above the bottom elevation of the wetland. Pits and or other man- made excavations within the wetland do not hold more than 50% of the total water volume **AND/OR** bottom of constructed outlet(s) is at least 8" above the bottom elevation of the wetland.	1.0 .75 .50 .10

Model Variable	Measurement or Condition	Index
V_{PDEN}: Plant Density Definition: Basal density of herbaceous plants in the wetland. Example: Plant Density effects water flow, microbial activities and wildlife habitat.	Density 75% to 125% of reference standard. Density From 25% to 75% or is Greater Than 125% of reference standards. Density 0 to 25% of reference standards.	1.0 0.5 0. 25

Model Variable	Measurement or Condition	Index
V_{PORE}: Soil Pores and Structure Definition: The physical quality of the soil within a depth of 50 cm (20 inches) from the soil surface. This includes detailed criteria as defined in the Soil Survey Manual for cracks, clods, structure, rupture resistance, roots, and non-matrix pores.	Many fine and/or very fine, continuous tubular pores with medium to high vertical continuity, -AND- structure is moderate or strong, medium and fine or subangular blocky, -AND/OR- structure is moderate or strong granular, -AND/OR- rupture resistance is friable or very friable.	1.0
Example: These soil properties indicate surface area for soil water contact and (therefore) increased surface area for microbial activity.	Common fine and/or very fine continuous and discontinuous tubular pores with medium to low vertical continuity, -AND- structure is weak or moderate, medium and/or fine angular or subangular blocky, -AND/OR- structure is weak or moderate granular, -AND/OR- rupture resistance is firm.	0.5
	Few, fine and/or very fine discontinuous tubular pores with low vertical continuity, -AND- structure is weak coarse subangular blocky or soil is massive (structureless) or soil has coarse clods, -AND/OR- rupture resistance is very firm, -AND/OR- plow pan evidenced by roots growing horizontally along pan.	0. 1
	Substrate is a non-porous medium (i.e. asphalt, concrete)	0.0

Model Variable	Measurement or Condition	Index
V_{PRATIO}: Ratio of Native to Non-Native Plant Species. Definition: The ratio of native perennial plants to annual plants as influenced by the level of disturbance in the wetland. Example: The presence of a high ratio of native perennial plant species indicates that disturbances that interrupt naturally occurring cycles and other vegetative dynamics are minimal.	All the dominant species in all zones are native perennial species. Impacts from grazing/haying are minimal. *Wetland is undisturbed prairie/rangeland.*	1.0
	Site is abandoned cropland (Greater Than 5 years) Vegetation consists of a mixture of native perennial species normally found in an undisturbed site and annual plants. Moderate impacts from grazing are present.	0.75
	Severely grazed or cropped site. Vegetation is dominated by FAC or wetter annual plants (ie annual smartweed,barnyardgrass)	0.50
	Site is dominated by annual invasive species which are FACU or Upland plants. Examples would include kocia, marestail, bindweed, foxtail.	0. 25
	Annually tilled site with no vegetation (excluding crops).	0.0

Model Variable	Measurement or Condition	Index
V_{SED}: Sediment Delivery to Wetland Definition: Extent of sediment within wetland from culturally accelerated sources. Example: Sedimentation levels will affect native plants and invertebrates. Visual sedimentation has a different color (i.e.lighter) and/or texture than the original surface layer.	Less Than or Equal to 2.5 inches of sediment in the wetland.	1.0
	sediment in the wetland is between 2.5 inches and 5.0 inches	0. 75
	sediment in the wetland is between 5.1 and 7.5 inches	0.5
	sediment in the wetland is between 7.6 and 10.0 inches	0.25

	sediment in the wetland is between 10.1 and 12.0 inches _____ sediment in the wetland is Greater Than 12.0 inches	0.1 _____ 0.0

Model Variable	Measurement or Condition	Index
V_{SOURCE}: Source Area Flow Interception Definition: Presence or alterations to landscape which affect flow paths and rates of water to the wetland. Example: Alterations to the contributing watershed impact surface and subsurface flow to the wetland.	No reduction of contributing drainage area of wetland.	1.0
	Contributing drainage area of wetland reduced by less than 10%.	0.75
	Contributing drainage area of wetland reduced by less than 25%.	0.5
	Contributing drainage area of wetland reduced by 50%.	0.25
	Contributing drainage area of wetland reduced by greater than 50%.	0.0

Parameters might include: linear feet of road ditches, linear feet of terraces, volume (area) of excavated pits, proximity to irrigation canal, tailwater recovery system, furrow irrigation row direction....

Model Variable	Measurement or Condition	Index
V_{SURWAT}: Duration of Surface Water Definition: Ponding must be present long enough for a invertebrate community to complete its life cycle. Example: Most invertebrate species require approximately 21 days to complete their life cycles.	28 days or greater continuous ponding	1.0
	21 -27 consecutive days	0.75
	14 - 20 consecutive days.	0.5
	7 - 13 consecutive days.	0.25

Model Variable	Measurement or Condition	Index
V_{UPUSE}: Upland Land Use Definition: Dominant land use and condition of upland watershed that contributes to the wetland. Example: Upland land use can effect all functions that a wetland performs.	Native prairie, never tilled	1.0
	Restored perennial cover (i.e. CRP or WRP).	0.75
	No-till farming, conservation tillage, good residue management, no fall tillage.	0.5
	Contour farming, conventional tillage, residues buried, fall tillage.	0.25
	Conventional tillage, residues buried, fall tillage, and with rows up - down slope into wetland assessment area (WAA).	0.1
	Point and/or non-point pollution from semi-pervious, or impervious surface (i.e. feedlots or paved roads).	0.0

Model Variable	Measurement or Condition	Index
V_{WDEN}: Density of Wetlands in the Landscape Definition: The absolute density of wetlands in a given water regime within the defined boundary.	At least six wetlands within a two mile radius	1.0
	Five wetlands within a two mile radius	0.75
	Three or four wetlands within a two mile radius	0.50
	Two wetlands within a two mile radius	0.25
	This is only wetland within two mile radius	0.0

Model Variable	Measurement or Condition	Index
V_{WETUSE}: Wetland Land Use **Definition:** Dominant land use and condition of the wetland. Example: Landuse in the wetland basin effects the ability of the wetland to function properly.	Wetland never tilled; and minimal impact from grazing and/or haying.	1.0
	Wetland rarely (Less Than or Equal to 2 yrs. out of 10) tilled; and/or minimal impact from grazing and/or haying.	0.75
	Wetland tilled Less Than or Equal to 5 yrs. out of 10 (50%); and light to moderate grazing, haying, or tillage.	0.5
	Wetland tilled Greater Than 5 yrs. out of 10 (50%)	0.25
	Wetland more severely disturbed than indicated above; (e.g. no vegetation, rutted, CAFO (Confined Animal Feeding Operation), urban fill, etc.)	0.0

Exhibit B
VARIABLES INDEX WORKSHEET
HIGH PLAINS PLAYAS

	WETLAND AREA (impacted)	MITIGATION AREA Before Const., Rest., Manip.	MITIGATION AREA After Const., Rest., Manip.
$V_{BUFFCON}$	_____	_____	_____
$V_{BUFFWID}$	_____	_____	_____
V_{CANOPY}	_____	_____	_____
$V_{DETRITUS}$	_____	_____	_____
V_{LANDSP}	_____	_____	_____
V_{MICRO}	_____	_____	_____
V_{MOD}	_____	_____	_____
V_{PDEN}	_____	_____	_____
V_{PORE}	_____	_____	_____
V_{PRATIO}	_____	_____	_____
V_{SED}	_____	_____	_____
V_{SOURCE}	_____	_____	_____
V_{SURWAT}	_____	_____	_____
V_{UPUSE}	_____	_____	_____
V_{WDEN}	_____	_____	_____
V_{WETUSE}	_____	_____	_____

Exhibit C
FUNCTIONAL CAPACITY INDEX EQUATION WORKSHEETS
HIGH PLAINS PLAYAS

HYDROLOGY

Function 1. Maintains characteristic of hydrologic regime: The capacity of the wetland to maintain characteristic static and/or dynamic storage, soil moisture, and ground water interactions.
Note: only used for closed basins

Index = $(V_{MOD} + V_{SED} + V_{SOURCE} + V_{UPUSE} + V_{WETUSE}) / 5$

(_____ + _____ + ____ + _____ + _____) / 5 = _____

or for other ***depressional wetlands that have significant dynamic storage from surface through-flows***:

Index = $[V_{MOD} + V_{SED} + V_{SOURCE} + V_{UPUSE} + V_{WETUSE} + ((V_{DETRITUS} + V_{MICRO} + V_{PDEN}) / 3)] / 6$

[_____ + _____ + _____ + _____ + _____ + (_____ + _____ + _____) / 3] / 6 = _____

BIOGEOCHEMICAL

Function 2. Maintains elemental cycling: Abiotic and biotic processes that convert elements (e.g., nutrients and metals) from one form to another. Primarily recycling processes.
Note: only used for closed basins

Index = $[((V_{BUFFCON} + V_{BUFFWID}) / 2) + V_{MOD} + V_{PDEN} + V_{PORE} + V_{SED} + V_{SURWAT} + V_{WETUSE}] / 7$

[((_____ + _____)/2) + _____ + _____ + _____ + _____ + _____ + _____] / 7 = _____

Function 3. Removes dissolved elements and compounds: The removal of imported nutrients, contaminants, and other elements and compounds via biotic and abiotic processes.
Note: only used for depressional wetlands with through-flow

Index = $[([((V_{BUFFCON} + V_{BUFFWID}) / 2) + V_{MOD} + V_{PORE} + V_{SED} + V_{SURWAT} + V_{WETUSE} + ((V_{DETRITUS} + V_{MICRO} + V_{PDEN}) / 3)] / 7$
(((_____ + _____)/2) + _____ + _____ + _____ + _____ + _____ + ((_____ + _____ + _____) / 3) / 7) = _____

Function 4. Retains particulates: Deposition and retention of inorganic and organic particulates (>0.45 µm) from the water column, primarily through physical processes.

If wetland has an outlet, then: Index = $[((V_{SED} + V_{UPUSE} + V_{WETUSE}) / 3) \times V_{MOD}]^{1/2}$

[((_____ + _____ + _____) / 3) x _____] $^{1/2}$ = _____

If wetland has no outlet, then: Index = $[((V_{SED} + V_{UPUSE}) / 2) \times V_{MOD}]^{1/2}$

[((_____ + _____) / 2) x _____] $^{1/2}$ = _____

Function 5. Exports organic carbon and detritus: Export of dissolved and particulate organic carbon and detritus from a wetland (e.g., through leaching, flushing, displacement, and erosion).
Note: only used for depressional wetlands with through-flow

Index = $[V_{MOD} \times [((V_{BUFFCON} + V_{BUFFWID}) / 2) + V_{WETUSE} + ((V_{DETRITUS} + V_{MICRO} + V_{PDEN}) / 3) / 3)]^{1/2}$

[_____ x (_____ + _____)/2) + _____ + ((_____ + _____ + _____) / 3)) / 3] $^{1/2}$ = _____

VEGETATION

Function 6. Maintains characteristic plant community: The capacity to perpetuate a plant community through maintaining mechanisms for seed dispersal, providing substrata conducive to seed burial and storage (seed bank), and conditions conducive to vegetative propagation (a response to stressors of drought and disturbances by fire and herbivores). This function emphasizes the dynamics and structure of a depression's plant community determined by species composition and abundance.

Index = $(V_{CANOPY} + V_{MICRO} + V_{MOD} + V_{PDEN} + V_{PRATIO} + V_{SED} + V_{WETUSE}) / 7$

(_____ + _____ + _____ + _____ + _____ + _____ + _____) / 7 = _____

WILDLIFE

Function 7. Maintain habitat structure within wetland: Soil, vegetation, and other aspects of ecosystem structure required by animals for resting, feeding, hiding, and reproduction.

Index = $[[(V_{BUFFCON} + V_{BUFFWID}) / 2) + V_{CANOPY} + V_{PDEN} + V_{PRATIO} + ((V_{SED} + V_{UPUSE} + V_{WETUSE}) / 3)] / 5$

[(_____ + _____)/2) + _____ + _____ + _____ + ((_____ + _____ + _____) / 3)] / 5 = _____

Function 8. Maintain food web: The production of organic matter of sufficient quantity and quality to support energy requirements of characteristic food webs.

Index =[(($V_{BUFFCON}$ **+** $V_{BUFFWID}$**)/ 2) +** $V_{DETRITUS}$ **+** V_{LANDSP} **+** V_{PRATIO} **+** V_{SED} **+** V_{UPUSE} **+** V_{WETUSE}**) / 7**

(((_____ + _____)/2) + _____ + _____ + _____ + _____ + _____) / 7 = _____

Function 9. Maintains habitat interspersion and connectivity among wetlands: The spatial distribution of a depressional wetland in relation to nearby wetlands.

Index = [F7 + V_{LANDSP} **+** V_{WDEN}**] / 3**

[_____ + _____ + _____] / 3 = _____

Hydrology = F1
Biogeochemical = sum and average of F2 + F4 (closed basin) or F3 +F4 + F5 (through flow)
Vegetation = F6
Wildlife = sum and average of F7 + F8 + F9

Exhibit D

Appendix E

LOTUS and EXCEL WORKSHEETS

HIGH PLAINS DEPRESSIONAL WETLANDS

WETLAND FUNCITONAL ASSESSMENT **COMPS.**

HIGH PLAINS (i.e. Playas)

UPLANDS (i.e. Rolling Hills)

F1 HYDROLOGIC REGIME "Option" =

Wetland Assessment Area (impacted) (enter 1 for

Mitigation Area (enter 1 for

				WETLAND ASSESS. AREA ***(impacted)***	**MITIGATION AREA** ***Before Const, Rest., Manip.***
2, 3, 5, 7, 8	**V**	BUFFCON	=		
2, 3, 5, 7, 8	**V**	BUFFWID	=		
6, 7	**V**	CANOPY	=		
1t, 3, 5, 8	**V**	DETRITUS	=		
8, 9	**V**	LANDSP	=		
1t, 3, 5, 6, 7	**V**	MICRO	=		
1, 1t, 2, 3, 4o, 4, 5, 6	**V**	MOD	=		
1t, 2, 3, 5, 6, 9	**V**	PDEN	=		
2, 3	**V**	PORE	=		
6, 7, 8	**V**	PRATIO	=		
1, 1t, 2, 3, 4o, 4, 6, 7, 8	**V**	SED	=		
1,1t	**V**	SOURCE	=		
2, 3	**V**	SURWAT	=		
1, 1t, 4o, 4, 7, 8	**V**	UPUSE	=		
9	**V**	WDEN	=		
1, 1t, 2, 3, 4o, 5, 6, 7, 8	**V**	WETUSE	=		

HYDROLOGY
BIOGEOCHEM
VEGETATION
WILDLIFE

UPLANDS (i.e. Rolling Hills) DEPRESSIONAL CLASS

	FUNCTIONS	WETLAND ASSESS. AREA *(impacted)* ~~VALUE (WI)~~	MITIGATION AREA *Before Const, Rest., Manip.* ~~VALUE (MAb)~~	MITIGATION AREA *AFTER Const, Rest., Manip.* ~~VALUE (MAa)~~
F1	**HYDROLOGIC REGIME (w/surface throughflow) [1t]**			
	HYDROLOGY			
F2	**ELEMENTAL CYCLING**			
F3	**REMOVAL OF IMPORTED ELEMENTS AND COMPOUNDS**			
F4	**PARTICULATE RETENTION (with an outlet) [4o] (no outlet)**			
F5	**EXPORTS ORGANIC CARBON AND DETRITUS**			
	BIOGEOCHEM			
F6	**MAINTAINS CHARACTERISTIC PLANT COMMUNITY**			
	VEGETATION			
F7	**MAINTAIN HABITAT STRUCTURE WITHIN WETLAND**			
F8	**MAINTAIN FOOD WEBS**			
F9	**MAINTAINS HABITAT INTER-SPERSION AND CONNECTIVITY AMONG WETLANDS**			
	WILDLIFE			

Exhibit E

PRODUCER CHECKLIST FOR MITIGATION

Note: All costs are owner responsibilities.

1. Are you willing to sign over to USDA a permanent easement for mitigation site?

   Yes _____ No _____

   If answer is No - Mitigation is not possible.

2. Do you have a suitable site located? (Mitigation site should be in same local watershed with similar soils, landscape position, and topography.)

   Yes _____ No _____

3. Do you own mitigation site? Yes _____ No _____
   If No, will you purchase easement rights? Yes _____ No _____

4. Is mitigation site recorded in Public Land Record? Yes _____ No. _____

5. Are there any existing Liens/Mortgages on mitigation site? Yes _____ No _____

6. Who will develop the mitigation plan?

   ____ Owner/operator
   ____ Employ another party to develop plan
   ____ Request assistance from NRCS and/or FWS to develop plan

7. Are you willing to obtain any/or all of federal, state, or local permits that apply to this project?

   Yes _____ No _____

REVISED DRAFT
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USER'S GUIDE

INTERIM FUNCTIONAL ASSESSMENT MODEL FOR PLAYA WETLANDS

CLASS: DEPRESSIONAL

SUBCLASS: HIGH PLAINS PLAYAS

CONTENTS OF USER'S GUIDE FOR INTERIM MODEL

EXPLANATION OF MODEL

The Interim Functional Assessment Model (IFAP) will be used to measure changes in wetland functions due to impacts to restoration. This document is being developed for depressional wetlands where the throughflow hydrology is not related to out of bank flooding. The present form of this model is based on the draft Rainwater basin and Pudget Sound hydrogeomorphic models and best professional judgment. This draft is a working document and is meant to provide the foundation for development of IFAP models particular to a specific subclass of wetlands within a defined boundary (Major Land Resource Area (MLRA) or group of MLRA's.)

The Hydrogeomorphic (HGM) approach to functional assessment follows three guiding principles: classification of the wetland according to geomorphic and hydrologic characteristics, identification of functions and standardization of the assessment by using variables calibrated to reference wetlands. Classification is used to partition natural variability in wetlands, so that the assessment can be built around a smaller subset of wetlands that share common structure and functioning. Functions are commonly recognized ecosystem processes, while variables are identifiable indicators of the strength of the function.

The choice of reference wetland sites is the most critical and controversial component of the HGM approach The choice of reference sites will influence the outcome of all subsequent assessments. If you select reference sites which are too diverse in nature, from either natural variation or manmade impacts, then the resulting assessment will lack the necessary resolution to detect significant losses in functions. If your reference sites are limited to a few pristine sites, either no comparable sites will exist in the landscape, or your model will be so limited in scope to have little practical use. This is why consensus of interdisciplinary teams is needed for the selection of reference sites.

Reference standard sites are the least altered sites of reference wetlands that best represent the wetland subclass. These wetlands have the highest sustainable level of functions possible within an MLRA.

FUNCTIONAL PROFILE

Appendix A

FUNCTIONAL PROFILE

Class: Depressional

Subclass Name: High Plains Playas

Reference Domain: Central and Southern High Plains

Existing classification:

NWI - PEMA, PEMC

Circular 39 - Type I , type 3

Climate: Semi-arid

Geomorphic Setting: Depression

Geologic Materials: Loamy, silty and clayey alluvium (palustrine and lacustrine) derived from eolian deposits, sedimentary rocks, or adjacent soils

Soils:

Hydric soils in playas - Ness and Pleasant soils in the Mesic Temperature Regime and Ranco and Randall soils in the Thermic Temperature Regime

Non-hydric soils in playas - Feterita (?) in the Mesic Temperature Regime and Lofton (?) , McLean, Southplains, Chapel, Lockney, and Lazbuddie in the Thermic moisture regime

Associated upland soils - see Geographically Associated Soils within each Official Series Description

Permeability of substrate- slow and very slow

Hydrology:

Water sources: Principally overland flow and direct precipitation

Water losses: Evapotranspiration and infiltration down towards the aquifer (recharge)

Water table: Perched

Saturation: Epi-saturated

Hydrodynamics: Mainly vertical fluctuations within the wetland

Hydrologic functions: Elemental cycling, removal of imported elements and compounds, particulate retentention, exports organic carbon and detritus

Biogeochemical functions: Maintains characteristic plant community

Vegetative Commununites:

Fully functional ecosystem characterized by:

Vegetative Red Flags (T&E):

Noxious plants/invaders:

Existing vegetative classification (not NWI):

Vegetative functions: maintains habitat structure within wetland, maintain food webbs, maintains habitat interspersion and connectivity among wetlands

Species that rely on the habitat of this subclass for all or part of their life cycles:

Invertebrates such as prairie shrimp and tadpole shrimp, shore birds, waterfowl, salamanders, deer , fox, rabbits, pheasant, etc.

Threatened and Endangered Species:

Live here: None

Pass through: Bald Eagle, Peregrine Falcon, Whooping Crane
Rely on: None

Complex with similar wetlands:

FUNCTIONAL PROFILE (cont.)

Existing literature about this subclass:

Kindscber K., Wilson S., Fraser A., Lauver C. 1996. Vegetation of Western Playa Lakes--1993-1995. Kansas Biological Survey Report No. 170, University of Kansas, Lawrence, KS

Current research on this subject:

Playa Lake Study by Wetlands Resource Technical Team, Garden City, KS

FUNCTIONS : Explanations and Associated Variables

1.0 Discussion of Function and Variables (Hydrologic Regime)

The capacity of a wetland to maintain characteristics static and/or dynamic storage, soil moisture, and ground water interactions (*Note: only used for closed basins)*

$$\textbf{Index} = (V_{MOD} + V_{SED} + V_{SOURCE} + V_{UPUSE} + V_{WETUSE})/5$$

or for other *depressional wetlands that have significant dynamic storage from surface throughflows:*

$$\textbf{Index} = [(V_{MOD} + V_{SED} + V_{SOURCE} + V_{UPUSE} + V_{WETUSE}) + (V_{DETRITUS} + V_{MICRO} + V_{PDEN})/3]/6$$

The "maintains characteristic hydrologic regime" function encompasses all the hydrologic attributes of depressional wetlands. All hydrologic processes are modeled by one function because depressional wetlands and their surrounding landscapes (watersheds) are tightly linked. For example, land-use activities in surrounding uplands (V_{UPUSE}) affects infiltration of precipitation, thus regulating the overland flow-to-groundwater ratio describing movement of water into depressional wetlands. Further, because overland flow land-use in a wetland depressional (V_{WETUSE}) may affect evapotranspiration, soil structure, and soil moisture.

Sediment delivery (V_{SED}) may completely eliminate dynamic and static water storage if a wetland fills with sediment and its basin is eliminated. Lowering the elevation of an outlet may drain a depressional wetland completely, while raising an outlet will cause a depression to flood more deeply (V_{MOD}). Further, source area flow interception (**Vsource**) of surface water with ditches or subsurface water with drainage tiles removes water that would otherwise flow to a wetland basin from its catchment.

Finally, for depressional wetlands that have substantial surface flow-through (e.g., inlets and outlets, roughness features ($V_{DETRITUS} + V_{MICRO} + V_{PDEN}$) serve to detain flow, thus contributing to dynamic storage.

Definition: The capacity of a wetland to maintain a hydrologic regime that supports static and/or dynamic storage, soil moisture in the unsaturated zone, and groundwater interactions.

Effects On-Site: Contributes to the maintenance of characteristic soils, vegetation, and invertebrate and vertebrate communities and provides for runoff water storage.

Effects Off-Site: Modifies off-site hydrology of wetland and riverine systems within the surface water and/or groundwater flow net.

2.0 Discussion of Function and Variables (Elemental Cycling)

$$\text{Index of function} = [((V_{BUFFCON} + V_{BUFFWID})/2) + V_{MOD} + V_{PDEN} + V_{PORE} + V_{SED} + V_{SURWAT} + V_{WETUSE}]/7$$

This function only used for closed basins

Elemental cycling requires wetland plants and soil microorganisms for uptake and release of elements through growth, decomposition, and leaching. Plants, influenced by land-use activities within a depressional wetland and its adjacent buffer zone ($V_{WETUSE} + ((V_{BUFFCON} + V_{BUFFWID})/2)$), provide a strong seasonal pulse of temporary storage and release of elements (including nutrients). (V_{PORE}), soil pores provide surface area for soil water contact and increased surface area for microbial activity. Seasonal uptake and release is a fundamental ecological function shared by all temperate and subtropical ecosystems containing plants.

Definition: Abiotic and biotic processes that convert elements (e.g. nutrients and metals) from one form to another. Primarily recycling processes.

Effects On-Site: Effects of cycling are elemental balances between gains through import processes and losses through, efflux to the atmosphere, long-term retention in sediments, and hydraulic export *(hydraulic export is minimal unless outlet leaves the basin, a reason to separate outlets that allow water to move elements and compounds out vs. pits which keep them on site*).

Effects Off-Site: To the extent that elements and nutrients are held (and processed) on-site, they are less available for export to downstream wetlands and to other aquatic environments.

3.0 Discussion of Function and Variables (Removal of Elements)

This function should only be used for depressional wetlands with throughflow.

The removal of imported nutrients, contaminants, and other elements and compounds via biotic and abiotic processes.

$$\text{Index} = [(((V_{BUFFCON} + V_{BUFFWID})/2) + V_{MOD} + V_{PORE} + V_{SED} + V_{SURWAT} + V_{WETUSE} + (V_{DETRITUS} + V_{MICRO} + V_{PDEN})/3)]/7$$

Removal of elements and compounds can occur in flow-through depressions by the more-or-less permanent accumulation of these constituents in sediments, by denaturation of complex organics, and by processes that release them into the atmosphere (e.g., denitrification). In forested depressions, storage of elements via uptake by trees represents a relatively long-term accumulation (sink) of elements. Therefore, land-use both within (V_{WETUSE}) and adjacent $((V_{BUFFCON} + V_{BUFFWID})/2)$ to a depression and the delivery of sediments (V_{SED}) are important to the removal of elements and compounds. (V_{PORE}) provides surface area for soil water contact and increased surface area for microbial activity. (V_{MOD})(if it lowers an outlet) may drain a wetland completely; and if it raises the outlet, (V_{MOD})will cause a depression to be deeper.

Microtopographic roughness (V_{MICRO}), plant density (V_{PDEN}), and detritus ($V_{DETRITUS}$) detain water flow to increase residence time for uptake and breakdown processes. Small-scale roughness also provides surfaces for attachment of microorganisms that are responsible for much of the sequestering, interconversion, and breakdown of imported materials.

Effects On-site: Nutrients and contaminants in surface and ground water that come into contact with sediments and vegetation are either removed over the long term by sedimentation or are transformed into innocuous and biogeochemically inactive forms.

Effects -Off-site: Chemical constituents removed and concentrated in wetlands reduce potential for downstream export to other wetland and aquatic ecosystems. In addition, removal of pollutants in soil solution reduces contamination of groundwater.

4.0 Discussion of Function and Variables (Retention of Particulates)

If wetland has an outlet, then:

$$\textbf{Index} = [((V_{SED} + V_{UPUSE} + V_{WETUSE}/3) \times V_{MOD}]^{1/2}$$

If wetland has no outlet, V_{WETUSE} is not relevant:

$$\textbf{Index} = [((V_{SED} + V_{UPUSE})/2) \times V_{MOD}]^{1/2}$$

When the function is applied to a depressional wetland that has a surface outlet, land-use activities within both the wetland watershed ($\mathbf{V_{UPUSE}}$) and wetland ($\mathbf{V_{WETUSE}}$) of a depression control the supply of particulates and the capacity of the depression to retain them. If a depression receives sediment ($\mathbf{V_{SED}}$) at a rate that prevents it from maintaining itself on the geologic timescales over which it was formed (i.e., it is filling), the function is not sustainable and receives a lower index score. However, if a depressional wetland has no surface outlet, it will trap sediments regardless of the types of activities that occur within its basin. Therefore, the land-use activity variable ($\mathbf{V_{WETUSE}}$) is omitted when modeling depressions without outlets.

Definition: Deposition and retention of inorganic and organic particulates (>0.45 um) from the water column, primarily through physical processes.

Effects On-Site: Sediment deposition in a basin is a natural geologic process that is maintained over thousands of years. The presence of these sediments and the soil-forming processes that follow result in the wetland having characteristic substrate, geochemistry, and hydrology.

Effects Off-Site: Reduces potential export of sediment to other wetland and aquatic systems downstream. *Off-site effects are minimal in a closed drainage system. The only way there is sediment carried off-site is if outlets are present.*

5.0 Discussion of Function and Variables (Organic Carbon Export)

$$\textbf{Index} - [(V_{MOD} \times (((V_{BUFFCON} + V_{BUFFWID})/2) + V_{WETUSE} + (V_{DETRITUS} + V_{MICRO} + V_{PDEN})/3)/3]^{1/2}$$

This function should only be used for depressional wetlands with throughflow.

Multiplying two sets of variables and calculating the square root emphasizes that this function has two interdependent requirements: (1) organic matter as a source of organic carbon; and (2) a pathway for exporting organic matter ($\mathbf{V_{MOD}}$). The presence of outlets in an assessed depressional wetland must be scored relative to appropriate reference standards. The remaining variables used in this function($\mathbf{V_{MICRO}}$, $\mathbf{V_{PDEN}}$, and $\mathbf{V_{DETRITUS}}$) reflect the source of organic matter.

Definition: Export of dissolved and particulate organic carbon and detritus from the wetland (e.g., through leaching, flushing, displacement, and erosion).

Effects On-Site: The removal of organic matter from living biomass, detritus, and soil organic matter contributes to carbon turnover (plant storage) and food web support.

Effects Off-Site: Provides support for food webs and biogeochemical processing.

6.0 Discussion of Function and Variables (Plant Community)

$$\textbf{Index} = [V_{CANOPY} + V_{MICRO} + V_{MOD} + V_{VPDEN} + V_{PRATIO} + V_{SED} + V_{WETUSE}]/7$$

The capacity to perpetuate a plant community through maintaining mechanisms for seed dispersal, providing substrate conducive to seed burial and storage (seed bank), and conditions conducive to vegetative propagation (a response to stressors of drought and disturbance by fire and herbivores). This function emphasizes the dynamics and structure of a depression's plant community, determined by species composition , abundance and species diversity.

The ability of the plant community to maintain itself or the changes that will occur over time in the community are captured by characterizing five variables. The species composition of the community (V_{PRATIO}) is used as an indicator of current conditions as compared to the reference standard. (V_{CANOPY}) are variables that are used to characterize the vertical structure (i.e., number of vertical layers of vegetation) in the plant community to compare to reference conditions.

Definition: Characteristic plant communities are not dominated by exotic or nuisance species. Vegetation is maintained by mechanisms such as seed dispersal, seed banks, and vegetative propagation which (all) respond to variations in hydrology and disturbances such as fire and herbivores. The emphasis is on the temporal dynamics and structure of the plant community as revealed by species composition and abundance.

Effects On-Site: Creates microclimatic conditions that support the life histories of plants and animals. Converts solar radiation and carbon dioxide into complex organic carbon that provides energy to drive food webs. Provides habitat for feeding, and cover for resting, refuge, escape, breeding and nesting for resident and migratory animals.

Effects Off-Site: Provides a source of vegetative propagules for adjacent ecosystems which assists in revegetation following drought or disturbance and provides for gene flow between populations. Provides habitat for animals from adjacent ecosystems and for migrating birds. (waterfowl, shorebirds, etc.)

7.0 Discussion of Function and Variables (Faunal Habitat)

$$\textbf{Index} = [((V_{BUFFCON} + V_{BUFFWID})/2) + V_{CANOPY} + V_{PDEN} + V_{PRATIO} + ((V_{UPUSE} + V_{SED} + V_{WETUSE})/3)]/5$$

As is true for a number of the other depresional functions, land-use activities (V_{WETUSE}) and sediment delivery (V_{SED}) are important in maintaining faunal habitat.

Definition: Soil, vegetation, and other aspects of ecosystem structure within a wetland are required by animals for resting, feeding, hiding, and reproduction.

Effects On-Site: Provides potential feeding, resting, hiding, escape, nesting and brooding sites for vertebrates and feeding surfaces for invertebrates.

Effects Off-Site: Provides habitat cover for migratory birds and for resident wildlife.

8.0 Discussion of Function and Variables (Food Webs)

$$\text{Index} = (((V_{BUFFCON} + V_{BUFFWID})/2) + V_{DETRITUS} + V_{LANDSP} + V_{PRATIO} + V_{SED} + V_{UPUSE} + V_{WETUSE})/7$$

Food webs require both an energy source (e.g., primary production of appropriate species of plants) and habitat for consumers. The indicators include the sustainability of a depression's basin (V_{SED}), landscape habitat factors (V_{LANDSP}) native to non-native plant species ratio (V_{PRATIO}) and the presence of litter and debris ($V_{DETRITUS}$)

Definition: The production of organic matter of sufficient quantity and quality to support energy requirements of characteristic food webs.

Effects On-Site: Provides the material of live and dead plant and animal tissue to support both terrestrial and aquatic food webs.

Effects Off-Site: Supports food webs of organisms that use other wetlands and terrestrial habitat.

9.0 Discussion of function and variables (Habitat Interspersion)

$$\text{Index} = [F7 + V_{LANDSP} + V_{WDEN}] / 3$$

Connectivity among wetlands is seen as essential to maintain habitat in both time and space through the presence of surface water connections to other aquatic ecosystems. While this function shares several variables with Function 7 (maintains faunal habitat), there is a fundamental difference between the two functions. Local habitat conditions reflecting land-use activities ($V_{LANDSP} + V_{WDEN}$) are interdependent with landscape-level variables through multiplication. A depression that scores zero in either local habitat attributes or potential landscape variables will not perform this function. Connectivity among wetlands is seen as essential to maintain habitat in both time and space through the presence of wetland complexes.

Definition: The spatial distribution of an individual wetland in reference to adjacent wetlands within the complex.

Effects On-Site: The assessed wetland contributes to habitat features of the wetland complex by virtue of its position in the landscape.

Effects Off-Site: Contributes to overall landscape diversity of habitat for aquatic and terrestrial organisms.

DEFINITION OF VARIABLES AND FUNCTIONS FOR DEPRESSIONAL WETLANDS

VARIABLES

$V_{BUFFCON}$ The continuity of the buffer zone surrounding the wetland effects how much of an impact the buffer zone has on the wetland.

$V_{BUFFWID}$ The width of the buffer zone surrounding the wetland effects how much of an impact the buffer zone has on the wetland.

V_{CANOPY} The canopy is used to characterize the quality of the plant community and wildlife habitat, particulate removal and elemental cycling.

$V_{DETRITUS}$ The detritus provides a microbial layer that effect water storage and breakdown processes.

V_{LANDSP} The condition of the landscape within a one mile radius of the center of the wetland being assessed determines the quality of potential dispersal area and home range for wetland and upland species.

V_{MICRO} The microtopographic roughness detains water flow to increase residence time for uptake and breakdown processes.

V_{MOD} Excavation or modification of a wetland basin will reduce the functional capacity of a wetland drainage.

V_{PDEN} Plant density will detain water flow to increase residence time for uptake and breakdown processes.

V_{PORE} The physical quality of the soil within a depth of 50 cm. from the soil surface.

V_{PRATIO} The species composition or plant ratio of native to non-native plants, in the community, is used as an indicator of current conditions as compared to the reference standard.

V_{SED} Extent of sediment delivered to wetland from culturally accelerated sources.

V_{SOURCE} The source area flow interception of surface water with ditches or subsurface water with drainage tiles removes water that would otherwise flow to a wetland basin from its catchment.

V_{SURWAT} The duration of ponding affects chemical and particulate removal from the water.

V_{UPUSE} The land use activities in the surrounding uplands influences infiltration of precipitation and movement of chemicals, sediment and ditritus into the wetland

V_{WDEN} Wetland landscapes often support many wetlands of different types (temporary, seasonal, and semi-permanent). The density and pattern of different types of wetlands in the landscape is related to how animals use them and hence their contribution to habitat.

V_{WETUSE} Land-use in a wetland depression affects vegetation evapotranspiration, soil structure, and soil moisture

FUNCTIONS

Maintains characteristic hydrologic regime: The function encompasses all the hydrologic attributes of depressional wetlands (by contrast, five hydrologic functions are identified for riverine systems in the Riverine Guidebook). All hydrologic processes are modeled by one function because depressional wetlands and their surrounding landscapes(watersheds) are tightly linked.

Elemental cycling: Elemental cycling requires wetland plants and soil microorganisms for uptake and release of elements through growth, decomposition, and leaching.

Removes dissolved elements and compounds: Removal of elements and compounds can occur in flow-through depressions by the more-or-less permanent accumulation of these constituents in sediments, by denaturation of complex organics, and by processes that release them into the atmosphere (e.g., denitrification).

Retention of particulates: When the function is applied to a depressional wetland that has a surface outlet, land-use activities within both the wetland watershed and wetland of a depression control the supply of particulates and the capacity of the depression to retain them.

Exports organic carbon and detritus: Export of dissolved and particulate organic carbon and detritus from the wetland (e.g., through leaching, flushing, displacement, and erosion).

Maintains characteristic plant community: The capacity to perpetuate a plant community through maintaining mechanisms for seed dispersal, providing substrate conducive to seed burial and storage (seed bank), and conditions conducive to vegetative propagation (a response to stressors of drought and disturbance by fire and herbivores). This function emphasizes the dynamics and structure of a depression's plant community, determined by species composition and abundance.

Maintain habitat structure within a wetland: As is true for a number of the other depresional functions, land-use activities and sediment delivery are important in maintaining faunal habitat. However, landscape-level factors are also important to this function and so are given equal weighting in the model. Landscape-level activities are especially critical for depressions isolated from surface water flows because isolation (defined by lack of inlet and outlet channels) prevents exchanges of obligate and facultative aquatic organisms with more permanent bodies of water.

Maintain food webs: Food webs require both an energy source (e.g., primary production of appropriate species of plants) and habitat for consumers (fauna).

Maintains habitat interspersion and connectivity among wetlands: Connectivity amount wetlands is as essential to maintain habitat in both time and space through the presence of surface water connections to other aquatic ecosystems. While this function shares several variables with "Maintain Food Webs", there is a fundamental difference between the two models.

TERMINOLOGY DEFINITIONS

TO BE ADDED LATER

CONTENTS OF INTERIM MODEL

INDEX (value for example based on "WI")

F1 HYDROLOGIC REGIME = [V{mod} + V{sed} + V{source} + V{upuse} + V{wetuse}) /5
(for depressional wetlands that have significant storage from
surface throughflows) = [(V{mod} + V{sed} + V{source} + V{upuse} + V{wetuse}) + (V{detritus} + V{micro} + V{pden})/3] / 6

F2 ELEMENTAL CYCLING (closed) = [((V{buffcon} +V{buffwid} / 2) + V{mod} + V{pden} + V{pore} + V{sed} + V{surwat} + V{wetuse}] / 7

F3 REMOVAL OF IMPORTED ELEMENTS
AND COMPOUNDS (throughflow)= [((V{buffcon} + V{buffwid}) / 2) + V{mod} + V{pore} + V{sed} + V{surwat} + V{wetuse}) + (V{detritus} + V{micro} + V{pden})/3] / 7

F4 PARTICULATE RETENTION
(with an outlet - throughflow [(V{sed} + V{upuse} + V{wetuse}) / 3) x V{mod}]$^{1/2}$
(no outlet / closed) [(V{sed} + V{upuse}) / 2) x V{mod})]$^{/2}$

F5 EXPORTS ORGANIC CARBON (requires throughflow - must have natual outlet)
AND DETRITUS = [V{mod} x (((V{buffcon} + V{buffwid}) / 2) + V{wetuse} + ((V{detritus} + V{micro} + V{pden})/3] / 3

F6 MAINTAINS CHARACTERISTIC
PLANT COMMUNITY = [V{canopy} + V{micro} + V{mod} + V{pden + V{pratio} + V{sed} + V{wetuse}] / 7

F7 MAINTAIN HABITAT STRUCTURE
WITHIN WETLAND = [((((V{buffcon} + V{buffwid}) / 2) + V{canopy} + V{pden} + V{pratio} + ((V{ sed} + V{upuse} + V{wetuse})/3] / 5

F8 MAINTAIN FOOD WEBS [((V{buffcon} + V{buffwid}) / 2) + V{detritus} + V{landsp} + V{pratio} + V{ sed} + V{upuse} + V{wetuse}] / 7

F9 MAINTAINS HABITAT INTER-
SPERSION AND CONNECTIVITY
AMONG WETLANDS [F7 + V{landsp} + V{pden}] / 3